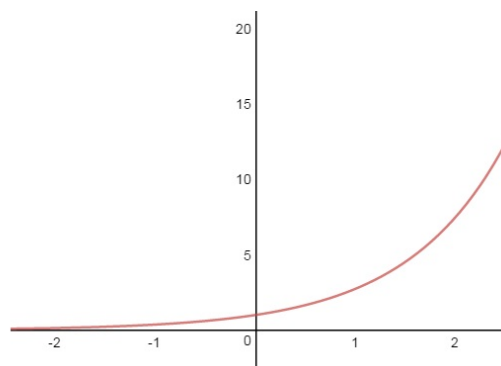
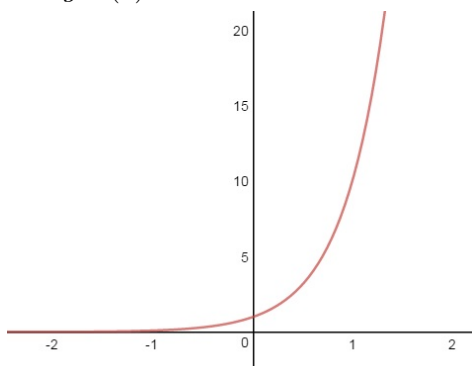


# Math 115

## Worksheet Section 1.4

Logarithms have a reputation for being confusing. One of the best ways to really understand them is to remember that they're the inverses of exponential functions.

**Problem 1.** (a) Use these graphs of  $f(x) = 10^x$  and  $g(x) = e^x$  respectively to estimate  $f^{-1}(15)$  and  $g^{-1}(5)$ .



(b) The base-10 logarithm of  $x$ , written  $\log_{10}(x)$  or just  $\log(x)$ , is the exponent we need to put on the 10 so that we get  $x$ . That is,  $\log_{10} x = c$  means...

(c) The natural logarithm of  $x$ , written  $\ln(x)$  is similar, except the base is  $e$  instead. So,  $\ln(x) = c$  means..

(d) Estimate  $\log_{10}(15)$  and  $\ln(5)$ .

**Problem 2.** (a) What is  $\log(1000)$ ?  $\log(1,000,000)$ ?  $\ln(e^{42})$ ?  $\ln(1)$ ?

(b) (1.4 #45)

At time  $t$  hours after taking the cough suppressant hydrocodone bitartrate, the amount,  $A$ , in mg, remaining in the body is given by  $A = 10(0.82)^t$ .

- (a) What was the initial amount taken?
- (b) What percent of the drug leaves the body each hour?
- (c) How much of the drug is left in the body 6 hours after the dose is administered?
- (d) How long is it until only 1 mg of the drug remains in the body?

**Note:** You should be comfortable using **all** the logarithm properties in the box on page 30.

- (c) Lily is studying a particular radioactive isotope of radon. Ten minutes into her experiment, she measures that only 15% of the radon remains. Find the **half-life** of this isotope. (You don't need any special formulas to do this!)

- (d) (1.4 #55)

In 2010, there were about 246 million vehicles (cars and trucks) and about 308.7 million people in the US.<sup>33</sup> The number of vehicles grew 15.5% over the previous decade, while the population has been growing at 9.7% per decade. If the growth rates remain constant, when will there be, on average, one vehicle per person?

**Problem 3.** Find the inverse of the function  $f(x) = 2^{3x}$  and state its domain and range.

**Problem 4.** For each of the following functions, sketch its graph, and find the domain, range, and asymptotes (on a separate sheet of paper).

- (a)  $f(x) = 2^{-x+1}$ , (b)  $f(x) = 3 + 2^x$ , (c)  $f(x) = \log_3(x - 1)$ , (d)  $2 - \log_2(x)$ .

**Problem 5.** Solve each one of the following equations, showing every step of your work (on a separate sheet of paper).

- (a)  $3^{2x-7} = 27$ , (b)  $5^{4-x} = \frac{1}{125}$ , (c)  $3^{2x} - 3^x - 6 = 0$ , (d)  $\log_2(5 - x) + \log_2(5 + x) = 4$ .